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Brief 68-10217

NASA TECH BRIEF

Computer Program Offers New Method for Constructing Periodic Orbits in Nonlinear Dynamical Systems

The problem:

To develop a method for constructing precisely periodic orbits which, at the start, dynamically approximates solutions that converge to precise dynamical solutions in the limit of the sequence. Previous methods isolated orbits with a sequence of precise dynamical solutions which at the start of the sequence has only approximate periodicity but which converges to a periodic solution in the limit of the sequence.

The solution:

A computer program that utilizes an iterative method for constructing periodic orbits in nonlinear dynamical systems.

How it's done:

The method used in this program is a modification of the generalized Newton-Raphson algorithm used in analyzing two point boundary problems. This technique is distinct in that it constructs a sequence of precisely periodic but, at the start, dynamically approximate solutions that converge to a precise dynamical solution in the limit of the sequence. The iterates are solutions of a linear system derived from the dynamical equations of motion. For conservative Hamiltonian systems, stability of the periodic orbit is determined as a byproduct of the method of iterating an orbit. Along the periodic orbit the trace of the resolvent (fundamental matrix) of the equations of variation determines uniquely the characteristic exponents of the orbit. An approximation to the resolvent along each iterate is determined in the solution of the linear system.

Notes:

1. This program is written in Fortran H for use on the IBM 360, Model 65 computer.
2. This program can be used in nonaerospace as well as aerospace calculations of periodic orbits in either circular or elliptic restricted three-body problems to develop qualitative information for space flight missions as well as detailed trajectories for motions of deep space stations in earth-moon systems.
3. Inquiries concerning this program may be made to:
   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B68-10217

Patent status:

No patent action is contemplated by NASA.

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Category 06